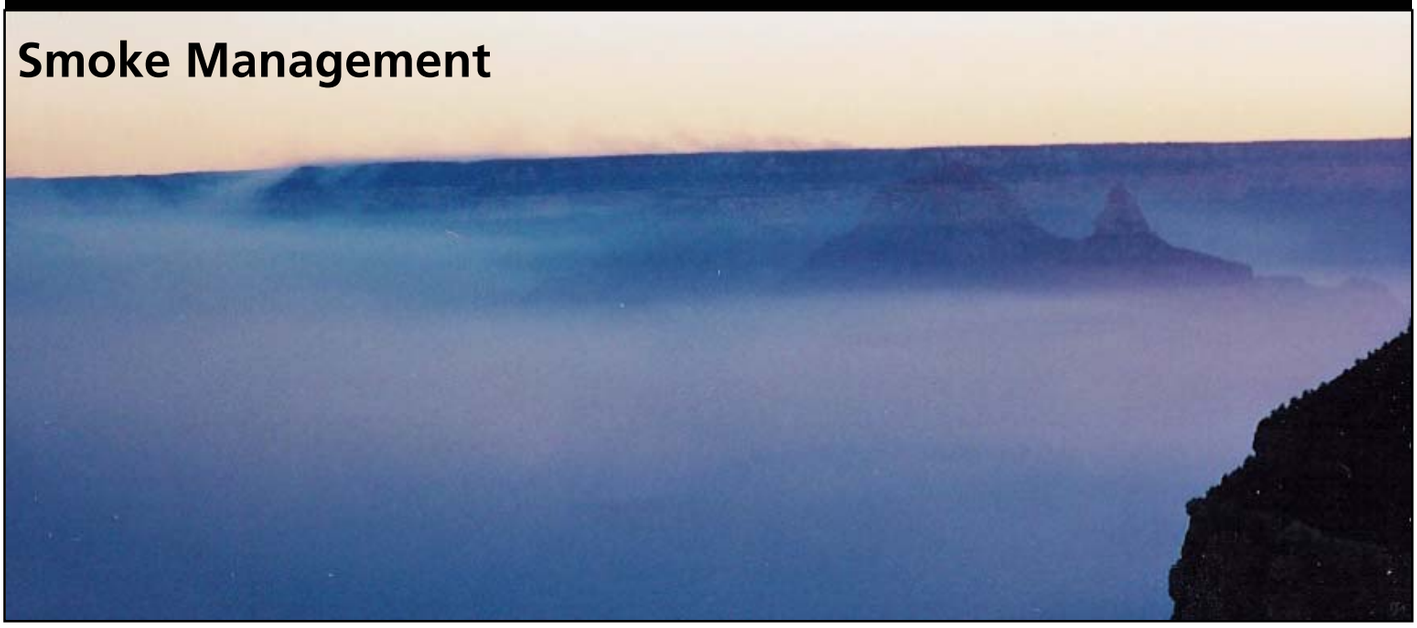
Grand Canyon

National Park Service
U.S. Department of the Interior

Grand Canyon National Park
Arizona

Smoke Management



The goal of an effective smoke management program is to avoid unacceptable smoke impacts to Grand Canyon, and return smoke levels to the natural levels found in a healthy, functioning ecosystem.

Issues in Smoke Management

Grand Canyon National Park has some of the cleanest air left in the "lower 48" United States.

As a "Class I" airshed, Grand Canyon N.P. receives the most stringent protection against increases in air pollution, and a goal of restoring natural visibility.

The National Park Service has the *responsibility* to protect park resources from air pollution, but the federal Clean Air Act gives the *authority* to protect Park air to the Arizona Department of Environmental Quality.

Many forests in Grand Canyon National Park depend on fire to cycle nutrients, control pests, and maintain their ecological structure. Restoring fire to its natural role in these systems is imperative.

Wildland fires can, and do, produce unacceptable air quality impacts.

Although wood smoke is mostly water vapor, it contains many pollutants, including carbon monoxide, various organic compounds and fine particles.

Dangerous exposures to carbon monoxide are rare, but may occur for firefighters in continuous, close proximity to the fire line itself.

Park staff concentrates overall air quality aspects of smoke management efforts on fine particles and their impacts.

Human Health

The U.S. Environmental Protection Agency (EPA) sets standards to protect human health from fine particles (PM_{10} and $PM_{2.5}$), including those in smoke. EPA standards allow less than 65 micrograms of $PM_{2.5}$ per cubic meter (ì g/m^3) averaged over a 24-hour period.

Fine particles are of concern because they can be inhaled deep into the lungs.

Health protection is of paramount importance, and National Park Service policy is to "err on the side of human health." During large fires, portable $PM_{2.5}$ monitors are used to ensure levels are cleaner than EPA health standards.

No violations of EPA standards in the Park have been recorded during wildland fires, even inside the Canyon where smoke settles at night.

Grand Canyon fire managers set $PM_{2.5}$ goals at 45 ì g/m^3 for 12 hours, well below the EPA standards, to allow a margin of safety for visitors and residents.

Although hourly $PM_{2.5}$ levels can rise above 45 ì g/m^3, episodes have been brief and 12- hour goal has been met.

Press releases may be issued to advise visitors and residents of heavy smoke, even if $PM_{2.5}$ levels do not exceed EPA or NPS thresholds. This precaution is taken because of the Park's elevation, dry air, and the strenuous activities many visitors are engaged in.

Visibility

Visibility is our ability to see through the air, and is influenced by lighting, weather, season, and air pollution.

Visibility is our most fragile air resource. Some air pollutants can cause haze at levels far below the concentrations that threaten health.

Almost all haze in Grand Canyon is the result of fine particles ($PM_{2.5}$). Most of this haze comes from sources far upwind of the Park, but fire is the largest source of PM within the Park.

The National Park Service routinely measures haze (including smoke) every hour, using a "transmissometer."

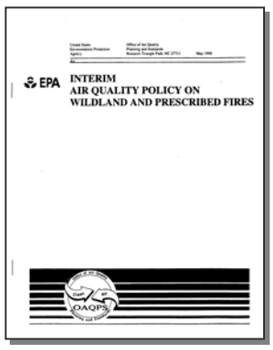
Some smoke in the Grand Canyon is an inevitable result of fire, even under natural conditions. Our goal is to minimize smoke's impacts as we restore fire's role in Park forests.

An EPA strategy to improve visibility is to "clean up" the haziest 20% of the time. Thus, the 20% level is used to assess the impact of smoke in Grand Canyon.

How Clear is the Air?

The photographs below show the range of visibility conditions at Grand Canyon. Notice that as light extinction rises, distant landmarks fade from view while colors and textures nearby become muted. Mount Trumbull (visible on the horizon under good or excellent conditions) is 77 miles away. Maintaining visibility during fires is a challenge for managers.

Management Constraints


EPA
INTERIM
AIR QUALITY POLICY ON
WILDLAND AND PRESCRIBED FIRES

Although fires can be managed to some degree, their behavior is inherently unpredictable.

Air quality monitoring provides specific data, but only at the equipment's location and at the measurement time. These data must be combined with "real world" observations and predictions to guide fire management.

Not all air quality monitoring equipment is available or suitable for all fires.

Smoke from unwanted wildland fires can not be managed, and these fires tend to produce more smoke than managed fires. Smoke is one of the factors considered by fire managers in deciding whether or not to manage fires for resource benefits.

Prescribed fire planning allows managers to reduce smoke impacts by manipulating:

- Smoke production; through fuel loads, acreage burned, or fire intensity
- Smoke dispersion; through ignition timing, or predicted weather conditions

The State of Arizona issues burning permits under Article 15, Range and Forest Burning (AAC R18- 2-15). Smoke management requirements are derived from the Clean Air Act, as reflected in the:

- Regional Haze Rule (rhfedreg.pdf),
- EPA Interim Air Quality Policy on Wildland and Prescribed Fires (firefnl.pdf,)
- Western Regional Air Partnership Policies on Fire Tracking Systems (FTSPolicy.pdf), Enhanced Smoke Management Programs for Visibility (ESMP_Policy.pdf), Characterizing Fire Emissions (natural vs. human, FirePolicy.pdf) and Annual Emission Goals for Fire (AEGPolicy1.pdf).

Notes